Objective Force Modeling and Simulation Tiger Team

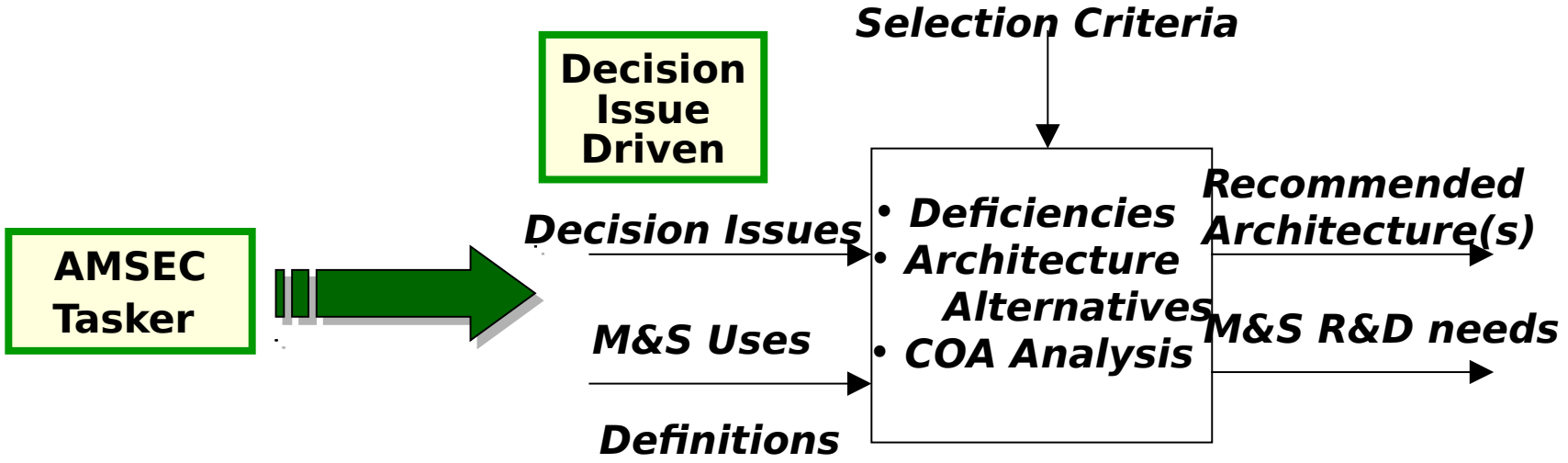
Task Force Objective Force

12 March 2001

Purpose

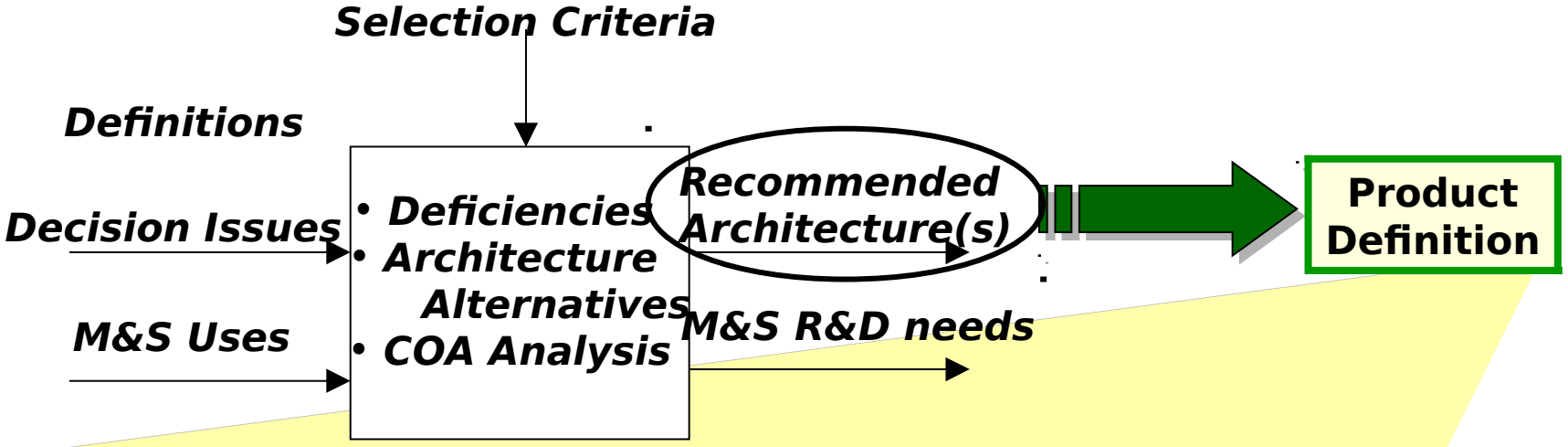
- Define Tiger Team process, products, and milestones
- Provide initial results
- Identify Way Ahead

Objective Force M&S Tiger Team



- **Tiger Team Membership:** TF OF, PM FCS, DUSA(OR), ASA(ALT), DCSOPS, HQ TRADOC, TRAC, HQ AMC, AMSAA, AMSO, MITRE
- **Scope/Goals:**
  - **Define Issues and Questions related to FCS Concept Downselect, Technology Readiness, and Systems Development and Demonstration Decisions**
  - Develop and recommend a Modeling and Simulation Architecture
  - Ensure that the M&S architecture provides a "sandbox" that allows comparison of concepts and demonstrators across contractors
  - Identify deficiencies in the planned architecture, and recommend research and development of models/simulations for key deficiency areas

Operational Architecture Definition



"The complete set of all the models and simulations used in a program, for all purposes from requirements definition through virtual prototyping, force-on-force modeling, training, etc. It also includes the definition of the relationships between models and simulations, such as direct interface (federation), data feeding from one model to another, or no direct interface. It includes the data requirements and inputs needed to drive the models, their level of fidelity, and the status of (and potential plans for) VV&A."

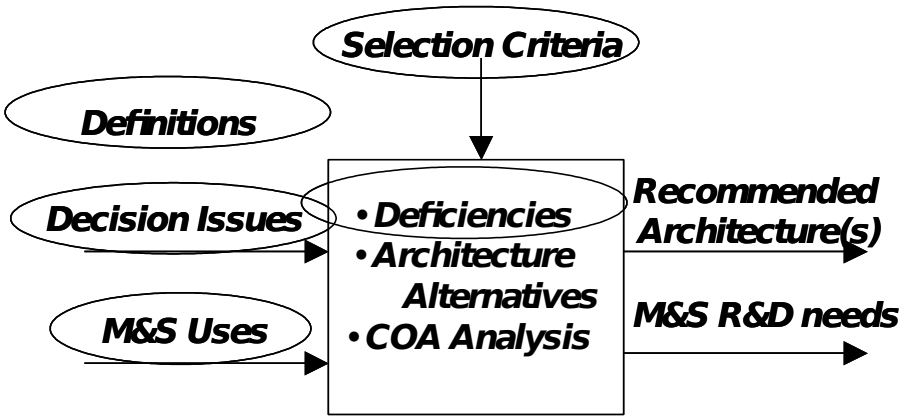
Initial Results - Objective Force M&S "Big Rock" Issues

- **C4/ISR**
  - C3 of FCS within the Unit of Action (1, 2)
  - C3 - FCS connectivity to the rest of the OF (2,3)
  - Communications, Target acquisition of dismounts, n-sided Simulation in Complex/Urban Terrain (1, 2)
  - IO/Degradation of Data/Information (1.2)
- **Lethality**
  - Complementary/Reinforcing Fires between Unit of Action and other Effectors (2)
- **Deployability**
  - Tactical/Operational Lift (1,2)
  - Strategic Deployment/On-board Capabilities (2)
  - Fight While Downloading from Tactical Lift a/c (3)
- **Sustainability**
  - Pulsed Logistics (2)
- **Cost**
  - Total Ownership Cost Analysis (2,3)
  - FCS Capability tradeoffs against the rest of the OF (2)
  - Embedded Training
- **Other**
  - Effect of Technological Maturity (2)
  - FCS in conjunction with Interim/Legacy, Joint, Coalition Warfare (1, 3)

Big Rock Issue =
• Cannot Simulate Combat Accurately without modeling this activity/component/ technology, and
• Currently Cannot Simulate/Model with our state-of-the-art M&S "toolkit", and
• Lack of M&S Capability Skews or Masks Results

Decision Pts:
(1) Concept Downselect – Nov 01
(2) Tech Readiness Decision – Apr 03
(3) SDD – FY06

Status – Where Are We?



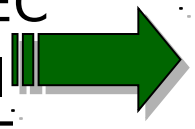
Defined:
- Initial Decision Issues for RDA Domain
- Conceptual Architecture
- Selection Criteria

Currently Working:
- Deficiencies
- Construct for Operational Architecture Alternatives

Future Work:
- Architecture Alternatives
- COA Analysis
- Architecture Recommendations
- M&S R&D Needs

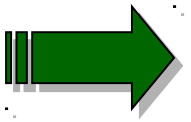
Initial Milestones

- 22 January – Initial Meeting
- 12 March – Macro Issues, Conceptual Architecture to AMSEC
- 4 April – RDA Issues, Operational Architecture, Required M&S to TF IPT
- April – SAG Review
- 25 April – S&T Review



Objective Force; But Initial Focus On FCS-MATDEV-Related Issues

- Apr/May - HQDA/ACR Issues, Architecture, Required M&S



Objective Force; Focus across DTLOMS and HQDA Needs

What's Left To Do?

- Complete Process for RDA Domain (Downselect is 1st Milestone)
- Complete Issues, Decision Points and Required M&S for HQDA and ACR domain
  - HQDA: TAA, POM, etc.
  - ACR: MNS, ORD, O&O
- Engage TEMO
- Decision Brief to TF IPT & SAG for Approval

Backup Slides

Major FCS Issues/Questions To Support Decisions (Example)

Decisions:	Concept Downselect	Technology Readiness	Dev & Demo
Issues/Questions			
1. What is the Objective Force and FCS O+O?	X	X	
2. What are the FCS requirements?	X	X	
3. What is the deployability, force effectiveness, supportability and sustainability of the contractor concepts (designs) in SSC and MTW scenarios and what is the life cycle cost?	X	X	X
4. How does the force effectiveness, deployability, supportability, sustainability, and cost of contractor concepts (designs) compare:			
4.1 To each other in SSC and MTW scenarios?	X	X	X
4.2 To IBCT in SSC scenarios?	X	X	
4.3 To IBCT with maximum technology insertion in SSC and MTW scenarios?		X	X
4.4 To legacy force in MTW scenarios?	X	X	

( ) reframing the question for Development and Demonstration phase where concepts evolve to designs.

Major FCS Issues/Questions To Support Decisions (cont)

	Decisions			
	Concept	Technology		
Issues/Questions	Downselect	Readiness	Dev & Demo	
5. What are the key contractor FCS capabilities (lethality, survivability, mobility, target acquisition, C4ISR, reliability, etc.) and technologies that drive force effectiveness, supportability, sustainability, deployability, and cost?	X	X	X	
6. What are the capability and technology, cost, performance, effectiveness, supportability, and sustainability tradeoffs?	X	X		
7. What are the technology risks?	X	X		
8. Will the technology be ready in time to support FCS development?	X	X		
9. Is the technology adequately funded?	X	X		
10. Have the key FCS technologies been demonstrated?	X	X		
11. Have the O+O concepts been validated?	X	X		

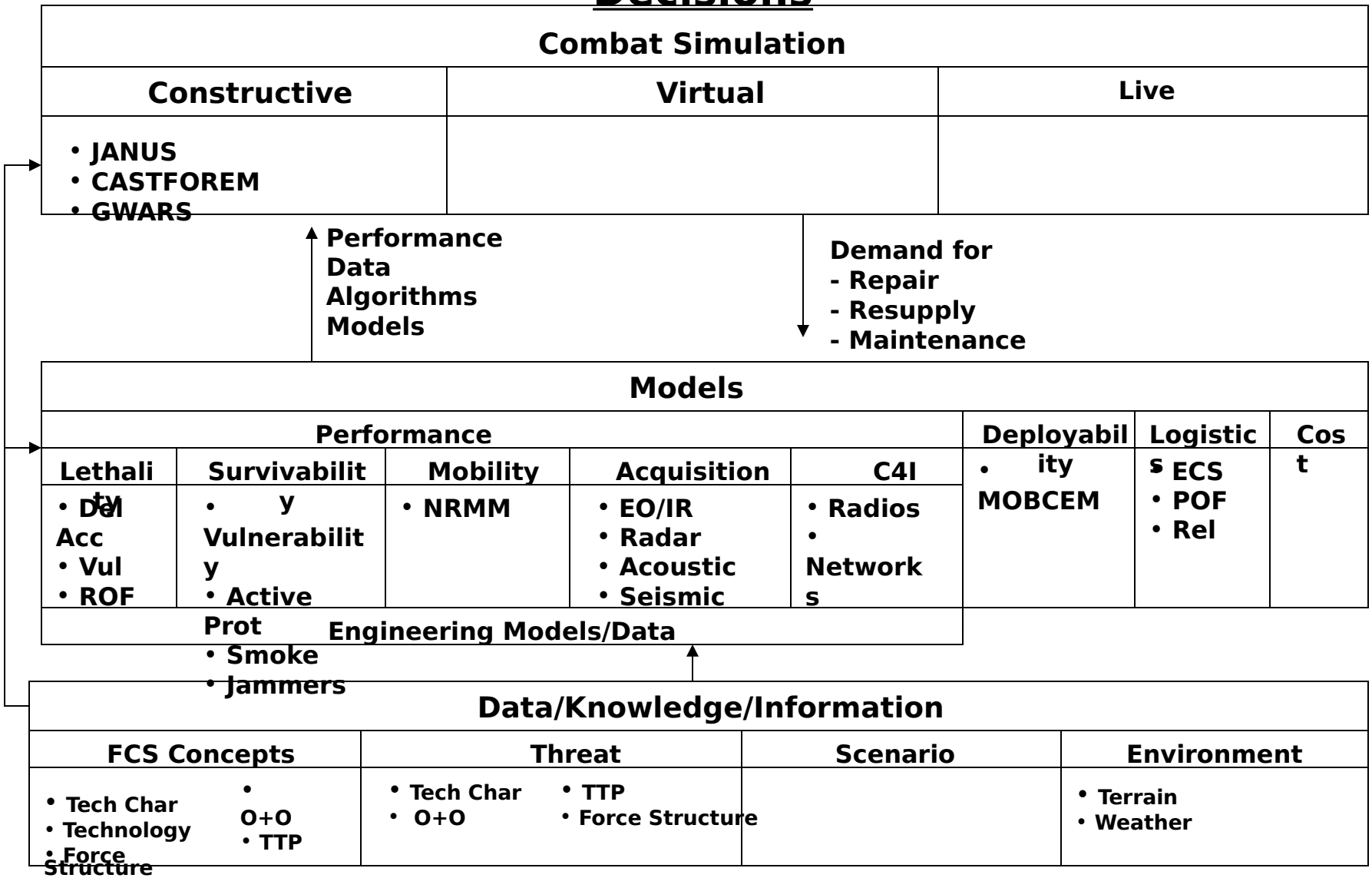
( ) reframing the question for Development and Demonstration phase where concepts evolve to designs.

Major FCS Issues/Questions To Support Decisions (cont)

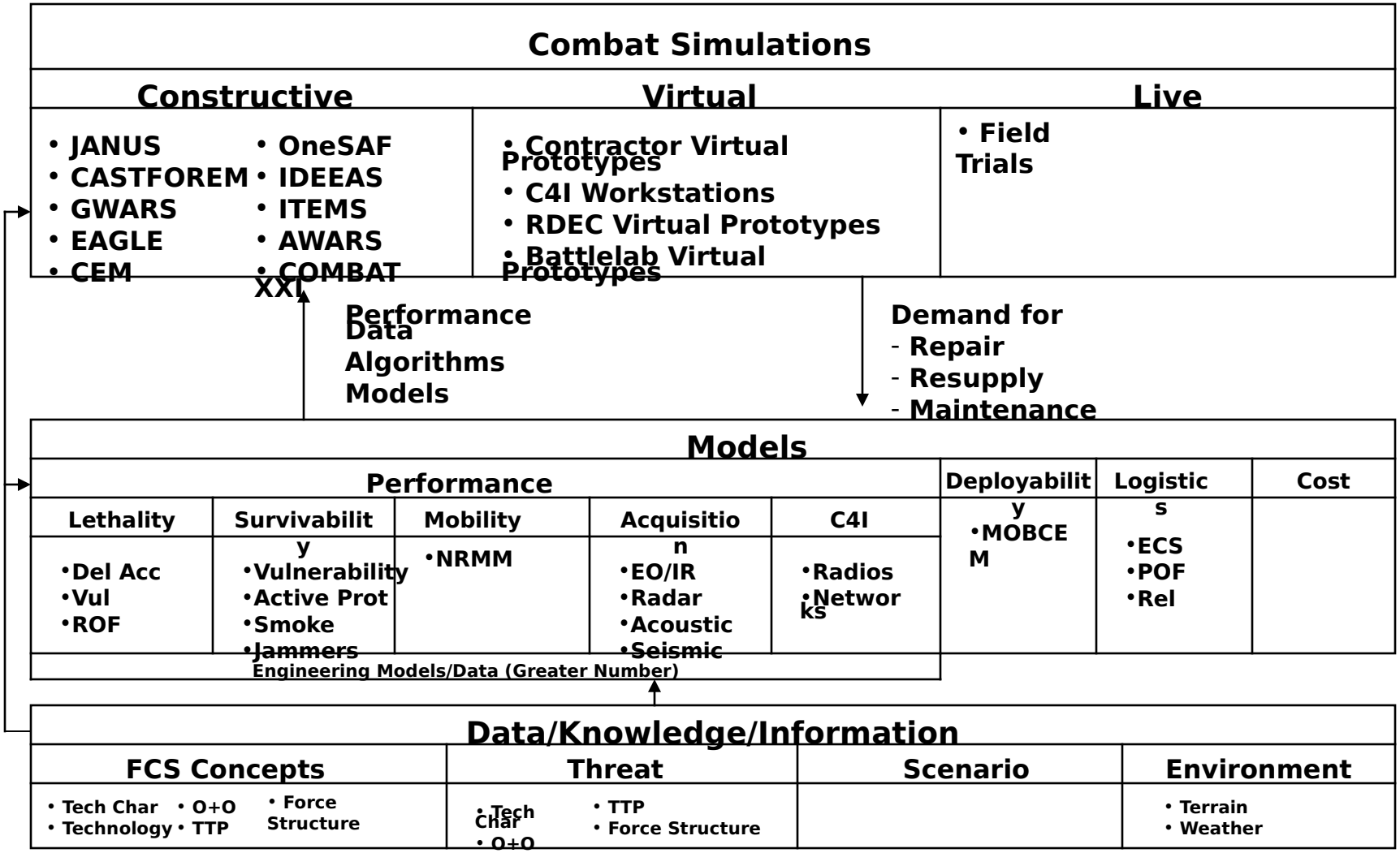
Issues/Questions	Decisions: Concept Downselect	Technology Readiness	Dev & Demo
12. Do the FCS contractor concept (designs) meet key needs/requirements:	X	X	X
12.1 Deployability			
12.2 Supportability			
12.3 Sustainability			
12.4 Mobility			
12.5 Lethality			
12.6 Survivability			
12.7 C4ISR			
13. What are the critical Objective Force CS, CSS, and C4ISR dependencies for FCS?		X	X
13.1 Are the planned Objective Force programs adequately funded to satisfy FCS needs?		X	X
13.2 Are the proposed FCS contractor C4ISR architecture concepts (designs) interoperable with the planned digitized force and what are the critical integration issues?	X	X	X
13.3 What is the Objective Force ownership cost?	X	X	
13.4 Are there sufficient funds programmed for the Objective Force? If not then what are the cost and effectiveness tradeoffs to live within available funds?		X	X

( ) reframing the question for Development and Demonstration phase where concepts evolve to designs.

M&S Operational Architecture Concept Downselect and Technology Readiness Decisions



M&S Operational Architecture
Development and Demonstration Decision



Initial Results - Objective Force M&S "Big Rock" Issues (Cont)

- **TRAC-WSMR (From FCS Combined Analysis Plan)**
  - Lethality
    - Trades for Direct Fire, Indirect FireF; Air Defense; OOTW NLW; Effectiveness
  - Survivability
    - Best Mix of the "Onion" to maximize crew protection; effectiveness at least cost; robotics, NBC, EM, Mines/Barriers
  - Mobility
    - Fording/Swimming; Transport; Fuel Consumption; Counter-mine
  - Operational Level Issues
    - Force Mixes, Comparison to Baseline, Alternative TTPs for Complex Terrain, SSC, SASO; Transport/Log; Support above the Unit of Action Level
  - Others
    - Bandwidth management, levels of SA, accuracy of BDA

Big Rock Issue =
• Cannot Simulate Combat Accurately without modeling this activity/component/ technology, and
• Currently Cannot Simulate/Model with SOA toolkit, and
• Lack of M&S Capability Skews or Masks Results

Proposed Issues – Original Set (TRAC-FLVN)

- **I. Decision: Concept Downselect 5/2002**
  - Concept Evaluation/System Performance: How will we model the sensor/decider/shooter linkages required for LOS/NLOS/BLOS fires? Goes beyond simply extending the range of legacy systems to 10-12 km. Sensor/decider/shooter may be on the same (e.g., tank) or different platforms (e.g., FO/FDC/Howitzer) or some combination, all as part of the close fight in the Red Zone.
  - Concept Evaluation/Force Effectiveness: How will we model the survivability in the OFOR? Traditionally this has been done with inputs such as P_H, P_K, etc. The OFOR O&O calls for an increased reliance on sensors and situational awareness. In order to measure the survivability of the OFOR we need to be able to model the effects of enhanced situational awareness.
  - TTP Development: Attention to TTP should extend to both the interim and legacy forces (integration issues – TTP for being part of a hybrid force).

Proposed Issues – Original Set (TRAC-FLVN) (Cont.)

- **II. Decision: Technology Readiness Decision 4/2003**
  - O&O (Operational Environment): Modeling emphasis is SSC/SASO will likely be on urban/complex terrain. Complexity here comes not only from the physical nature of the terrain, but also from situational complexity (difficulty separating combatants from non-combatants, restrictive ROE, etc.).
- **III. Decision: System Development & Demonstration Decision – 2006**
  - Concept Evaluation/Force Performance: We need to be able to model forces fighting immediately upon offloading from deployment transports. This might simply be a linking of deployment and combat models.

Proposed Issues – Original Set (TF OF)

I. Decision: Technology Readiness Decision 4/2003

- **Technology Assessment**
  - Can the task force use modeling and/or simulation to help with technology readiness assessments? If so, how?
  - How do we simulate the effects of immature or less reliable/easily degradable technology in the FCS?
  - How do we simulate the operational impact from different technology choices?
- **Concept Evaluation**
  - How do we compare the FCS contractor concepts against either interim or legacy force baselines?
  - How do we account for and/or model other Blue assets (Army, Joint, Coalition) that FCS will interact with?
  - How do we simulate degrees of interoperability, or degraded interoperability, with Joint or Coalition forces?
- **Affordability**
  - How can we best – i.e. realistically - determine the life cycle cost of the FCS?
  - How can we use modeling and simulation to reduce IOT&E costs?
- **Requirements Determination**
  - How do we model higher level tradeoffs – i.e. FCS Unit of Employment; notional Divisional/Corps/EAC - to balance FCS requirements vs. requirements in other Objective Force systems or SoS.
  - How do we model the use of different tactical lift capabilities to determine the effect on the FCS Unit of Action warfighting capabilities?
- **POM Development/Justification**
  - What modeling/simulation information supporting the concept downselect information will be necessary to help convince OSD and the Joint Staff of our decision?

Proposed Issues – Original Set (TF OF) (Cont.)

II. Decision: System Development & Demonstration Decision – 2006

- **Technology Assessment**
  - Can the task force use modeling and/or simulation to help with the Demonstrator technology readiness assessments – i.e. system/SoS TRL vs. component TRL? If so, how?
  - How do we model the effects of immature or less reliable/easily degradable technology in the FCS SoS?
- **Concept Evaluation**
  - AoA update - How do we compare the FCS contractor concepts against either interim or legacy force baselines?
  - How do we account for and/or model other Blue assets (Army, Joint, Coalition) that FCS will interact with?
  - How do we simulate degrees of interoperability, or degraded interoperability, with Joint or Coalition forces?
- **Affordability**
  - How can we best – i.e. realistically – update our life cycle cost estimates of the FCS?
  - How can we use modeling and simulation to reduce IOT&E costs?
- **Requirements Determination**
  - How do we model higher level tradeoffs – i.e. FCS Unit of Employment; notional Divisional/Corps/EAC - to balance FCS requirements vs. requirements in other Objective Force systems or SoS.
  - How do we model the use of different tactical lift capabilities to determine the effect on the FCS Unit of Action warfighting capabilities?
- **POM Development/Justification**
  - What modeling/simulation information supporting the concept downselect information will be necessary to help convince OSD and the Joint Staff of our decision?

Proposed Issues – Original Set (PM FCS)

- Assess FCS Capability in context of Objective Force
- C3 of FCS w/in Objective Force
  - Parallel Planning & IPB w/higher echelon feeds
  - Seamlessly integrate organic and all source fires
  - Deconflict battle space from organic and higher parent effects
  - National, Interagency, joint, theater, operational & tactical information integration
  - to enable self synchronization & self organization
- Complementary and Reinforcing fires between FCS and Objective Force
  - Exploit Objective Force support via complementary fires, CAS, artillery, etc
  - Complement, amplify, exploit shaping effects from higher parent
  - Exploit volume and duration of fire support from Objective Force, Joint and
  - coalition forces
- Strategic Deployment & On-Board Capabilities
  - Strategically deploy via C-130
  - Live/virtual mission planning & rehearsal in parallel w/ deployment
  - Constant update/refinement of plans during deployment
  - Plans synchronized and approved en-route
  - Task Organization accomplished virtually en route

Proposed Issues – Original Set (PM FCS) (Cont.)

- Operational Deployment
  - Aerial position of battalion via Future Transport Rotorcraft
  - Aerial position of dismounts via utility helicopters
- Pulsed Logistics for FCS
  - Aerial sustainment for extended distances and emergency replenishment
  - Reach back logistics using mission staging sites
  - Coordination w/ maneuver sustainment elements so FCS 1) moves to sustainment, 2) sustainment pulses to FCS unit of action, or 3) link ups occur in rhythm of maneuver operation
- Embedded Training for FCS
  - Combined Arms/collective embedded training strategy
  - Distance learning to support force readiness and operations
  - Linked training and operational systems including Objective Force Components
- Total Ownership Cost Analysis
  - Cost to upgrade C-130 to enable deployability capability (see above)
  - Cost to upgrade pulsed logistics operations capability
  - Cost to integrate combined arms training capability

Proposed Issues – Original Set (TRAC-WSMR)

SYSTEM LEVEL ISSUES:

LETHALITY

- SA-L-1 What Combination of Target Acquisition, Terminal Effects and Rate of Fire produce the most cost effective direct fire system?
- SA-L-2 What Combination of Target Acquisition, Delivery Accuracy, Terminal Effects and Rate of Fire produce the most cost effective indirect fire system
- SA-L-3 Should FCS have both direct and indirect fire capabilities?
- SA-L-4 What is the optimum means of distributing the Air Defense tasks across the FCS equipped force?
- SA-L-5 OOTW: Non-lethal targets – mechanism for temporarily incapacitating or controlling people?
- SA-L-6 What is the effectiveness of each competing weapon system?

SURVIVABILITY

- SA-S-1 What is the best combination of detection avoidance, hit avoidance, penetration avoidance and kill avoidance to maximize the protection to the crew of the FCS platform from direction and indirect fires and mines operating in MTW, SSC, and SASO scenarios?
- SA-S-2 Which suite of survivability enhancements incorporated on the various FCS platforms provides the best effectiveness for the least cost?
- SA-S-3 What is the impact on crew and platform survivability by equipping units with robotic platform?
- SA-S-4 Can the FCS platforms/crews survive and operate with minimal mission degradation in an NBC environment?
- SA-S-5 How Susceptible is the FCS to Electromagnetic Environmental Effects (E3)?
- SA-S-6 How Susceptible is the FCS to minefields and barriers?

Proposed Issues – Original Set (TRAC-WSMR) (Cont)

MOBILITY

- SA-M-2 What are the practical/realistic design considerations/constraints for fording and swimming?
- SA-M-3 What is the capability of the FCS to be transported by various modes to include air, ship and highway?
- SA-M-4 What are the fuel consumption characteristics of the FCS concepts and to what degree is the fuel consumption reduced over that of the baseline force? SA-M-5 What is the mine clearing capability of the FCS platform? What is the breaching capability?

Proposed Issues – Original Set (TRAC-WSMR) (Cont)

OPERATIONAL LEVEL ISSUES

- OA-1 What are the expected threats in the FCS timeframe?
- OA-2 What is the optimum mix of FCS platforms to maximize combat effectiveness over the potential missions and scenarios?
- OA-3 How should lethality tasks be distributed among the FCS platforms to maximize lethality while meeting deployability requirements?
- OA-4 Should the FCS have both direct and indirect fire capabilities?
- OA-5 What are the effects of a minefield on the distributed FCS systems?
- OA-6 Proper Force Mix for OOTW/MTW/SSC?
- OA-7 What is the optimal force structure associated with the FCS concepts?
- OA-8 What are the force level effectiveness trades for each FCS force design?
- OA-9 How do the FCS concepts (platform and TTP) compare to the baseline in various scenarios?
- OA-10 What alternative TTPs could be employed with the FCS to improve performance in MOUT, SSC, and SASO?
- OA-11 What is the deployability of each FCS concept?
- OA-12 What is the capability to move FCS force structure in CONUS, inter-theater and intra-theater?

Proposed Issues – Original Set (TRAC-WSMR) (Cont)

OPERATIONAL LEVEL ISSUES (Cont)

- OA-13 Can the FCS concept force be deployed within the required time?
- OA-14 What levels of reliability, availability and maintenance will be required to achieve FCS program objectives given OPTEMPO of scenarios?
- OA-15 What is the force effectiveness of each design constrained by tactical logistics considerations?
- OA-16 What reduction in fuel, ammo, parts, force structure is required to meet the logistics footprint objective?
- OA-17 What are the impacts of the FCS logistics footprint objective on Force Reception, discharge, onward movement of forces, positioning of facilities, infrastructure…
- OA-18 What are the impacts of the FCS logistics footprint objective on Arming, Fueling, Fixing, Moving and Sustaining?
- OA-19 How do we support each concept at Division, Corps and Theater?
- OA-20 What changes in methodology, data, M & S are required to support future logistics analyses?

Others For Consideration:

- What are the bandwidth requirements associated with the network-centric FCS force in various modes of operation?
- What effect does varying levels of situational awareness have on FCS force effectiveness?
- What effect does varying levels of accuracy in battle damage assessment information have on FCS force effectiveness?